REMARKS

The claims have been amended to include the style of this application.

Claim 1 sets forth two parallel flow tubes curved into an arch shape having joint ends where each of the joint ends has an end direction. In the embodiment of present Fig. 1, the flow tubes are represented by reference numbers 1 and 2. Claim 1 also sets forth an entry side manifold and an exit side manifold which are separate from the flow tubes. One of these manifolds is represented by reference 25 in the embodiment of Fig. 1. The other manifold is hidden in the view of Fig. 1. The manifolds are set forth as having curved branches being smoothly bent from an inlet direction to a connection direction. The connection direction is set forth in claim 1 as being the same as the end direction of the joint ends of the flow tubes.

In the embodiment of Fig. 1, the joint tube 1 has a curve that is opened in the downward direction. The curved branches of manifold 25 in Fig. 1 are curved in a somewhat upper direction. The left side of the branch of manifold 25 is in the same direction as the right side end of flow tube 1. Claim 1 therefore sets forth the structures of the flow tubes, and the manifolds each having one curve. These curves are shaped, so that the flow meter can be assembled without any additional curves being required.

Applicant has found that forming two curves in a single structure is difficult, especially with regard to reproducing those same two curves over and over again. Applicant has also found that it is much easier to have uniformity between flow tubes, when each flow tube is formed with a single bend. Applicant has found that this is possible when exhaust manifolds are formed separately from the flow tubes. Each branch of each flow tube is formed with a single

curve. Each flow tube is also formed with a single curve. The curves of the branches and the tubes are formed so that the end of each curved branch is in the same direction as the end of the respect flow tube. This avoids the problem of forming curved flow tubes or manifolds with two or more curves. The vibrational characteristics of each flow tube and manifold are then easier to make uniform during mass production. Corresponding inaccuracies due to variations in vibrational characteristics are thus lowered.

Applicant has reviewed the prior art, and finds no teaching nor suggestion of separate flow tubes and manifolds having only one curve, and where a connection between the separate manifolds and the flow tubes are in the same direction. The rejection states that Lew has flow tubes 44 and 45 joined to manifolds 47 and 47. Applicant assumes the Examiner is referring to elements 46 and 47 of Lew. Applicant has reviewed these elements of Lew, and in particular Fig. 5 of Lew. Applicant finds no teaching nor suggestion in Lew of separate structures of a manifold and a flow tube. Instead it appears that Fig. 5 of Lew shows a one piece construction and does not provide any details with regard to how any manifolds or flow tubes are formed. Lew clearly does not indicate separate manifolds and flow tubes, and cannot indicate how and where a manifold would be connected to a flow tube. Therefore Lew cannot disclose the specific relationship between the manifolds and the flow tubes in claim 1. Since this specific relationship is not present in Lew, Lew cannot anticipate this feature of claim 1, or cause this feature to be considered obvious.

The rejection also indicates that Keita discloses a similar arrangement of elements that comprise two measuring tubes 13 and 14 as shown in Figs. 2a and 3 that have a similar shape

as the tubes 1 and 2 in Applicant's Figs. 1, and 7. Applicant has reviewed Figs. 2b and 3 of Keita, and does not find any teaching nor suggestion of a manifold with curved branches, especially where ends of the curved branches are in a direction that is similar to the direction of the ends of the flow tubes. Instead it appears from Figs. 2a and 3 of Keita that elements 13 and 14 have three individual bends, and that any manifold does not have any bends or curved branches at all. Therefore Keita cannot anticipate all of the features of claim 1, especially the relationship between the flow tubes and the manifolds.

Applicant has further reviewed Keita, and notes that Figs. 5 and 7 of Keita clearly show flow tubes 34 and 44 having a bend in the center, and two bends at each of the right and left ends. Elements 31 and 32 appear to be the structure most similar to the manifolds of the present invention, however elements 31 and 32 do not have any curved branches. Therefore it is quite clear that Keita does not have the relationship between the manifolds and the branches set forth in claim 1.

Applicant further notes that the tubes in Fig. 5 in Lew, and Keita, have more than one bend which Applicant has found to be disadvantageous. As Applicant has described previously, and in the original specification, it is difficult to uniformly and repetitively produce flow tubes having more than one bend or curve. None of the prior art seems to recognize the difficult reproducibility of flow tubes or the inaccuracies that it creates. It is only the present Applicant who recognizes this difficulty, and provides a solution. The flow meters of the present invention are therefore easier to produce, more accurate and/or less costly to manufacture. The specific flow tube and manifold combination of present claim 1, therefore is an improvement

over the prior art, by providing more accurate or less expensive flow meters. Applicant respectfully requests patent protection for this improvement.

Applicant also notes that the embodiment of Fig. 5 of Lew does not use a pair of oscillation sensors installed along two parallel flow tubes, as set forth in claim 1, but instead uses differential pressure sensors 50 and 51. Figure 5 of Lew therefore is a different type of meter and may not have the same difficulties with vibration. Applicant has found that the difficulty of forming more than one curve in a flow tube causes difficulty in having the same vibration characteristics from flow tube to flow tube. The oscillation sensors of the present invention measure the vibration of the flow tubes. Since the embodiment of Fig. 5 of Lew does not measure vibration or oscillation at two separate points, but instead measures differential pressure, a person of ordinary skill in the art would not be led to believe that the particular shape of Fig. 5 of Lew would also be beneficial when a pair of oscillation sensors are used to measure vibration. Therefore it is Applicant's position there would be no incentive or motivation for the person of ordinary skill in the art to take the shape of Fig. 5 of Lew and incorporate that into Cage.

The rejection states that it would have been obvious to modify Cage using the teachings of Lew or Keita since Cage himself suggests that a plurality of shapes and flow conduits could be utilized as long as they oscillate in a resonant manner. Applicant notes that Lew describes in column 8 lines 44 - 53, that the invention of Lew can be flexually vibrated at any desired frequencies, which may or may not be a natural frequency. Therefore a person of ordinary skill in the art looking for shapes of conduits that oscillate in a resonant manner, would not be led

to the conduits of Lew. Lew is not concerned with natural frequencies, and operates on frequencies other than natural frequency. A person of ordinary skill in the art would have no indication in Lew, that the shapes of flow conduits would oscillate in a resonant manner. Therefore the suggestion or motivation in the rejection is contradicted by Lew, since Lew does not indicate that a resonant or natural frequency is needed. Claim 1 therefore further defines over the combination of the references.

Claim 5 also sets forth separate flow tubes and manifolds. The manifolds are set forth as having exit passages with a smooth curve where an axial direction of the passages at the ports or ends is in substantially the same direction as an axial direction of a respective end of a respective flow tube. This feature is similar to the relationship between the separate curved branches and the flow tubes in claim 1. As Applicant has described previously, this separate relationship between flow tubes and manifolds joining in a same direction is not taught nor suggested in the prior art. Claim 5 therefore defines over the prior art for the same reasons as claim 1.

Claim 5 also sets forth that the two flow tubes have a curve and that each curve forms an arch extending fully from a respective first joint end to a respective second joint end. Applicant notes that the main prior art of Cage does not show two flow tubes each having a curve where each curve forms an arch extending fully from a respective first joint end to respective second joint end. Instead it appears that Cage describes U-shaped tubes which clearly have two bends and three straight portions. Applicant notes that in the rejection of claim 5, Cage is used to disclose the flow tubes by elements 11 and 11'. Since elements 11 and 11'

in Cage do not form an arch extending fully from a respective first end to a respective second end, the rejection does not show how all of the features of claim 5 are present in the prior art. The statements supporting the rejection are therefore untenable.

Claim 5 further sets forth that the direction of the outlet ports of the entry side manifold are at an acute angle relative to the axial direction of the inlet port. Likewise claim 5 also sets forth that the direction of the exit passages the exit side manifold is at an acute angle relative to the axial direction of the outlet port portion. This further emphasizes the difference in the shape between the flow tubes of claim 5 and the prior art, since the ends of the flow tube of claim 5 are in the same direction as the passages of the manifold. The rejection appears to use the reference of Lew to show the acute angle, and states that it would have been obvious to use the shape of Lew, since Cage suggests that a plurality of shapes of flow conduits could be utilized as long as they oscillate in a resonant manner. However Lew describes in column 8 lines 44 - 53 that the invention of Lew can be flexually vibrated at any desired frequency which may or may not be a natural frequency. Therefore a person of ordinary skill in the art looking for shapes of conduits that oscillate in a resonant manner, would not be led to conduits of Lew. There is no indication that the conduits of Lew would resonate at a desirable natural frequency. Instead Lew is designed to operate of frequencies other than natural frequency. The suggestion or motivation then in Cage that a plurality shapes or flow conduits could be utilized as long as they oscillate in a resonant manner, therefore does not apply to Lew. Claim 5 therefore further defines over Lew.

Applicant also finds no suggestion or motivation in the prior art which would lead a

person of ordinary skill to replace the U-shaped tubes of Cage with tubes having a curve that form an arch extending fully from one end to another. Applicant notes that the U-shaped tubes in Cage, and the placement of the sensors in Cage clearly indicate that the deflection of the flow tubes is based on the fluid flow in a direction that is perpendicular to the original flow. Therefore sufficient length must be provided in this perpendicular direction so that the deflection is of a large enough magnitude to be accurately measured. As described previously, the measuring in the perpendicular or lateral direction has several advantages that increase accuracy. However, this design also has the disadvantage of requiring an excess amount of space. Replacing the U-shaped tube of Cage with a tube having a curve forming an arch extending fully from one end to another, would change the principal of operation of Cage. Applicant notes that such a modification is not an indication of obviousness according to U.S. patent regulations. Claim 5 therefore further defines over the prior art.

New claims 13 - 20 have been added to further emphasize the features of the tubes and manifolds being separate structures, and the tubes having only a single curve. These claims therefore also define over the prior art.

Claim 2 sets forth that the Coriolis meter further comprises a sealed pressure resistant case of a cylindrical case with openings of the cylindrical portion being closed by end plates. In the embodiment of present Fig. 1, the case is represented by reference 31, and the end plates by reference 32. Applicant's review of Cage, finds no teaching nor suggestion of a cylindrical case, with openings in the cylindrical portion being closed by end plates. It appears that the rejection relies on element 14 of Cage for this structure. However Applicant finds no teaching

nor suggestion of element 14 having openings which are closed by end plates.

Claim 2 also sets forth that the entry side and exit side manifolds are installed at corners of the case and are passed through the corners. It appears from Cage, that element 14 is spherical in shape, especially from Fig.1 of Cage. Applicant finds no teaching nor suggestion of element 14 having corners, or of manifolds being arranged at corners of a case. From Figs. 2 and 5 of Cage, it appears that element 14 is not perfectly spherical, but still does not have any corners. It also appears that elements 12 and 12' of Cage which have been equated with the manifolds of the present invention, are not even mounted in any of the smaller radius portions of element 14 of Cage. Cage therefore appears to clearly fails to show any manifolds being mounted even remotely close to any corners of element 14. Claim 2 therefore further defines over the prior art.

Claim 3 also sets forth a pressure resistant case. Claim 3 then sets forth that the entry side and exit side manifolds have a pair of integrally formed disk-shaped flanges to which ends of the pressure resistant case are fixed. The rejection relies on element 14 of Cage to teach a pressure resistant case. The rejection also states that elements 12 and 12' of Cage have a pair of integrally formed disk-shaped flanges to which both ends of the case are fixedly fitted. Applicant has reviewed elements 12 and 12' of Cage, and finds no teaching nor suggestion of disk-shaped flanges which are fitted to ends of element 14. The rejection states that this feature is shown in Fig. 1 of Cage. However Applicant's review of Fig. 1, only finds that any disk-shaped flange of elements 12 and 12' is clearly spaced from element 14. Therefore it is Applicant's position that Fig. 1 of Cage does not anticipate the relationship between the disk-

shaped flanges and the manifolds and the case of claim 3. Claim 3 therefore further defines over the prior art.

Claim 4 sets forth temperature sensors provided on the pressure resistant case for compensating the thermal effects of a distance between fixed ends on both sides of the flow tubes. Applicant has reviewed the applied references, and finds no teaching nor suggestion of a temperature sensor on a case, and of the temperature sensors provided near joints connecting flow tubes to manifolds. Applicant does find Cage to describe a temperature sensor assembly 72. However this is not applied to the case, is not applied adjacent to joints connecting flow tubes to manifolds. Claim 4 therefore further defines over the prior art.

The rejection recognizes that Cage fails to teach the utilization of a second temperature sensor and holds that this would be obvious since the mere duplication of essential working parts of a device only involves routine skill in the art. However Applicant notes that this is not a mere duplication, since the first temperature sensor is arranged on the pressure case, and the second temperature sensor is arranged on one of the flow tubes and the manifolds. These temperature sensors measure different temperatures, and therefore the use of two temperature sensors is not mere duplication, but instead the two temperature sensors of claim 4 set forth unique relationships. The prior art does not teach the unique relationships of each of the temperature sensors of claim 4, and therefore claim 4 further defines over the prior art.

Claim 6 sets forth that the axial directions of the first joint ends are non-parallel with the axial directions of the second joint ends. The rejection uses Lew for this feature, and indicates that it would have been obvious to incorporate this feature from Lew into Cage since Cage

suggests that a plurality of shapes or flow conduits could be utilized as long as they oscillate in a resonant manner. Applicant notes that the tube arrangement in Cage is such that the perpendicular portions of tubes 11 oscillate toward and away from each other. If these perpendicular portions of Cage were modified so that they did not have axial directions which were parallel to each other, these perpendicular portions would fan out from the manifold in Cage. Such a fanning out of the perpendicular portions, would increase the amount of space required by Cage, and make it difficult to vibrate the tubes. Applicant finds no benefit to such a fanning out. Therefore it is Applicant's position that a person of ordinary skill in the art would not be modified to have any axial directions of joint ends of flow tubes in Cage be non-parallel. Claim 6 therefore further defines over the prior art.

Claim 7 sets forth a slightly similar feature in that the directions of the joint ends are angularly spaced from each other. Again Applicant finds no teaching nor suggestion of how this would be beneficial in Cage. Therefore claim 7 also further defines over Cage.

Claim 8 depends from claim 5 and sets forth a sealed pressure case surrounding the two flow tubes, where the pressure case has a cylindrical shape and where ends of the cylindrical shape are closed by end plates forming corners with the cylindrical shape. The rejection uses element 14 of Cage to anticipate the case. The rejection states that element 14 of Cage has a cylindrical shape with ends of the cylindrical shape closed by end plates forming corners with the cylindrical shape. Applicant has reviewed Cage, and finds no teaching nor suggestion of element 14 being closed by end plates, with those end plates formed corners with a cylindrical shape. Claim 8 also sets forth that the entry and exit manifolds are arranged in the corners of

the case. Since Cage clearly does not teach nor suggest corners, Cage cannot suggest manifolds being arranged in Corners. Claim 8 therefore further defines over the prior art.

Claim 9 sets forth that the ends plates are flanges of the entry and exit manifolds. As Applicant has described previously, Cage does not describe end plates, and therefore cannot describe end plates that are flanges of entry and exit manifolds. Furthermore, Applicant notes that any structure of elements 12 and 12' are not part of element 14. Therefore flanges of 12, and element 14 of Cage do not have the same relationship as the flanges and case of claim 9. Claim 9 therefore further defines over the prior art.

Claim 10 sets forth temperature sensors provided on the pressure resistant case for compensating the thermal effects of a distance between fixed ends on both sides of the flow tubes. Applicant has reviewed the applied references, and finds no teaching nor suggestion of a temperature sensor on a case, and of the temperature sensors provided near joints connecting flow tubes to manifolds. Applicant does find Cage to describe a temperature sensor assembly 72. However this is not applied to the case, is not applied adjacent to joints connecting flow tubes to manifolds. Claim 10 therefore further defines over the prior art.

The rejection recognizes that Cage fails to teach the utilization of a second temperature sensor and holds that this would be obvious since the mere duplication of essential working parts of a device only involves routine skill in the art. However Applicant notes that this is not a mere duplication, since the first temperature sensor is arranged on the pressure case, and the second temperature sensor is arranged on one of the flow tubes and the manifolds. These temperature sensors measure different temperatures, and therefore the use of two temperature

sensors is not mere duplication, but instead the two temperature sensors of claim 10 set forth unique relationships to the other structure of the claim. The prior art does not teach the unique relationships of each of the temperature sensors of claim 10, and therefore claim 10 further defines over the prior art.

Claim 11 sets forth that each curve is continuous from the first joint end to the second joint end. The rejection indicates that Cage does not describe each curve being continuous from a first joint end to a second joint end. The rejection then uses the references of Lew or Keita for this feature. As Applicant has described previously, the reference of Cage uses a U-tube, and requires that long straight perpendicular portions to cause the deflection. Applicant notes that if a curved section was substituted in Cage, the long straight sections would not be present and the amount of deflection in Cage would be less. This would make it more difficult to measure the deflection and reduce the accuracy.

The rejection also states that it would have been obvious to use the shapes of Lew or Keita in Cage, since Cage themselves suggests in column 13 lines 30 - 33 that a plurality of shapes of flow conduits could be utilized as long as they oscillate in a resonant manner. Applicant notes that there is no indication that the shapes of Keita or Lew oscillate in a resonant manner. Therefore the rejection lacks the suggestion or motivation to cause claim 11 to be obvious.

Claim 12 sets forth entry-side and exit-side manifolds being separate structures from the flow tubes. Each of these manifolds have an inlet portion or an outlet portion respectively. Each of these manifolds also has branches that bend at an acute angle to the axial direction of

the inlet or outlet portions. The rejection acknowledges that Keita fails to depict the arrangement of these manifolds. The rejection then uses the reference of Lew to teach these manifolds, especially Fig. 5. As Applicant has described previously, Lew provides no distinction or separation between flow tubes and manifolds, especially in Fig. 5. Therefore Lew does not describe the manifolds of claim 12. The combination of the references therefore fails to anticipate all of the features of claim 12, and claim 12 therefore defines over the prior art.

The rejection further states that it would have been obvious to modify Keita in view of Lew, in order to provide multiple conduits that can be resonantly oscillated about an axis that will allow flow measurements to be made in an accurate and efficient manner by also reducing turbulence. Applicant notes that any suggestion or motivation to modify a reference must be found in the prior art, or in the general knowledge of a person of ordinary skill in the art. The rejection does not indicate where this suggestion or motivation can be found in the prior art, or in the general knowledge. Applicant's review of the prior art finds no indication of this suggestion or motivation being found in the prior art. Therefore claim 12 further defines over the prior art, since the suggestion or motivation to combine the reference is not found in the prior art of the general knowledge.

In section 5 of the last Office Action, the Examiner indicates that the motivation to combine the art is found in the knowledge generally available to one of ordinary skill in the art, and the references cited are all from analogous art. Applicant notes that the references of Cage and Keita use sensors for measuring vibrations or velocities of the tubes, see Keita abstract last line, and Cage column 1 lines 32 - 38. The reference of Lew on the other hand uses two

differential pressure sensors 12 and 13, see abstract last line. Therefore it does not appear that the references are all from analogous art. Applicant also traverses the statement that the motivation to combine the art as found in the knowledge generally available to one of ordinary skill in the art. Applicant respectfully requests that the Examiner provide support for the motivation to combine in accordance with MPEP 2144.03.

If the Examiner has any comments or suggestions which would further favorable prosecution of this application, the Examiner is invited to contact Applicant's representative by telephone to discuss possible changes.

At this time Applicant respectfully requests reconsideration of this application, and based on the above amendments and remarks, respectfully solicits allowance of this application.

Respectfully submitted
for Applicant,

By: _____
Theobald Dengler
Registration No. 34,575
McGLEW AND TUTTLE, P.C.

TD:tf
6859GRCE.12

DATED: March 16, 2004
SCARBOROUGH STATION
SCARBOROUGH, NEW YORK 10510-0827
(914) 941-5600

SHOULD ANY OTHER FEE BE REQUIRED, THE PATENT AND TRADEMARK OFFICE IS HEREBY REQUESTED TO CHARGE SUCH FEE TO OUR DEPOSIT ACCOUNT 13-0410.